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DISPERSAL OF PLANT PARASITIC NEMATODES AFTER PASSAGE THROUGH THE DIGESTIVE TRACT OF ENDOTHERMS.

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Plant parasitic nematodes are known to be disseminated after they are ingested by animals. At least five genera of plant parasitic nematodes have been shown to be viable after passage through the digestive tract of endotherms. Animals that have been shown to have potential for this type of dispersion of quarantine pests are humans, sheep, swine, cattle, chickens, rabbits, guinea pigs, white rats, mice, moles, armadillos, and various bird species.

HUMANS: In 1919, in the course of a hookworm survey of U.S. Army personnel stationed at Camp Travis, Texas, Kofoid and White erroneously described a new nematode infection of man (8). This nematode, which was described as *Oxyuris incognita*, was found in 429 of approximately 140,000 samples examined. It is now known that this nematode belongs to the genus *Meloidogyne*, and that the eggs which Kofoid and White observed in fecal samples of soldiers probably originated from roots of vegetables they had eaten. Since then other reports of living eggs and larvae of plant parasitic nematodes in the feces of humans have been published. Such occurrences are obviously not uncommon. In Mississippi the incidence of *Meloidogyne* eggs in human feces was 1:1200 (7). In Sao Paulo, Brazil, the incidence was as high as 17% (14).
In South Africa, eggs of *Meloidogyne* were encountered
in 9 of 1,013 samples (4). It is not known if larvae are infective after passage through the digestive tract of humans.

DOMESTIC LIVESTOCK AND OTHER MAMMALS: The earliest research on dispersal of nematodes, after ingestion by animals, concerned studies on wheat seed infected with *Anguina tritici* (Steinbuch) Chitwood. As early as 1909, Marcinowski examined the excrement of chickens, gophers, marmots, and mice that had been fed seeds infected with this nematode, but found live larvae only in the mouse excrement (11). In 1924 Leukel conducted similar studies with domestic livestock. He found that *A. tritici* passed through the digestive tract of horses, cows, and hogs, but the larvae that were found were not viable (10).

In 1936, Bacigalupo fed various types of animals several food sources that were infected with different plant parasitic nematodes. He found that *Subanguina radicicola* (Greeff) Paramonov eggs passed through white rats, and three days after feeding galled roots of *Poa annua* to guinea pigs he found live larvae and eggs in their excreta. He also found that eggs of *Ditylenchus dipsaci* (Kuhn) Filipjev passed through rabbits and guinea pigs that were fed infected alfalfa stems. He observed that eggs of *Melóidogyne* sp. passed through guinea pigs and white rats that were fed roots with galls caused by root-knot nematode. Eggs and larvae of *Meloidogyne* sp. were recovered from the excrement of an armadillo (1). Other studies indicate that *Meloidogyne arenaria* (Neal) Chitwood larvae are viable and infective after passage through the digestive system of a bovine (Jersey cow) and *M. javanica* (Treub) Chitwood is capable of infecting host plants after passage through the digestive tract of a mole (*Cryptomys hottentotus* Lesson) (12,13).

Viable cysts of *Globodera rostochiensis* (Wollenweber) Behrens have been found in the fecal samples of sheep (3). *Heterodera schachtii* Schmidt can pass through the alimentary canal of cattle and reinfect sugarbeets (9). Low numbers of *H. glycines* Ichinohe were recovered from cysts that passed through swine, but the larvae that were recovered did not reproduce on soybean (15).

BIRDS: In 1909 Marcinowski fed galls of wheat containing *A. tritici* to goldfinches, and succeeded in infecting wheat plants by placing the excrement of these birds with the seeds sown. Viable larvae of *A. tritici* have also been recovered from the excrement of pigeons, *Columba livia*, and sparrows (genus not designated by authors) (10,11).

Viable juveniles of the soybean cyst nematode, *Heterodera glycines* were recovered from the excrements of three species of blackbirds (brown-headed cowbirds, *Molothrus ater*, grackles, *Quiscalus quiscula*, and starling, *Sturnis vulgaris*) (5). Seven of 54 starlings that were trapped in an infested soybean field contained cysts of *H. glycines* in their digestive tract. Some of the cysts contained viable eggs, and larvae that hatched from these eggs reproduced on soybean (5).

Birds have been implicated in the spread of *G. rostochiensis* to Japan (6). This nematode was first discovered in Japan in 1972. Cysts of *G. rostochiensis* were found in samples of guano which had been imported from Peru to Japan in 1969, and greenhouse studies have demonstrated that larvae from these cysts reproduced on potatoes (6). It is not known how the guano becomes infested. During migration, en route to the islands off Peru where they produce guano, sea birds feed in potato fields in the

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coastal areas of Peru. It is possible that cysts are ingested during feeding or that these birds carry infested soil on their feet.

Brodie found that the effects of ingestion of G. rostochiensis by birds varied among the six bird species that he studied. Viability of cyst contents was inversely related to the time the cysts remained in the digestive system. His study indicated that viability may be reduced by chemicals in the bird excrement and the high body temperature of birds (2).

Conclusion: Research to date indicates that low numbers of certain plant parasitic nematodes remain viable and are capable of reproducing on their plant hosts after they pass through the digestive tract of endotherms. The potential for endotherms to ingest and disperse plant parasitic nematodes should be a consideration in regulatory decisions.

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